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RESPONSE COUNTER FOR TOTALIZING CURRENT SURGES OF VARYING MAGNITUDES

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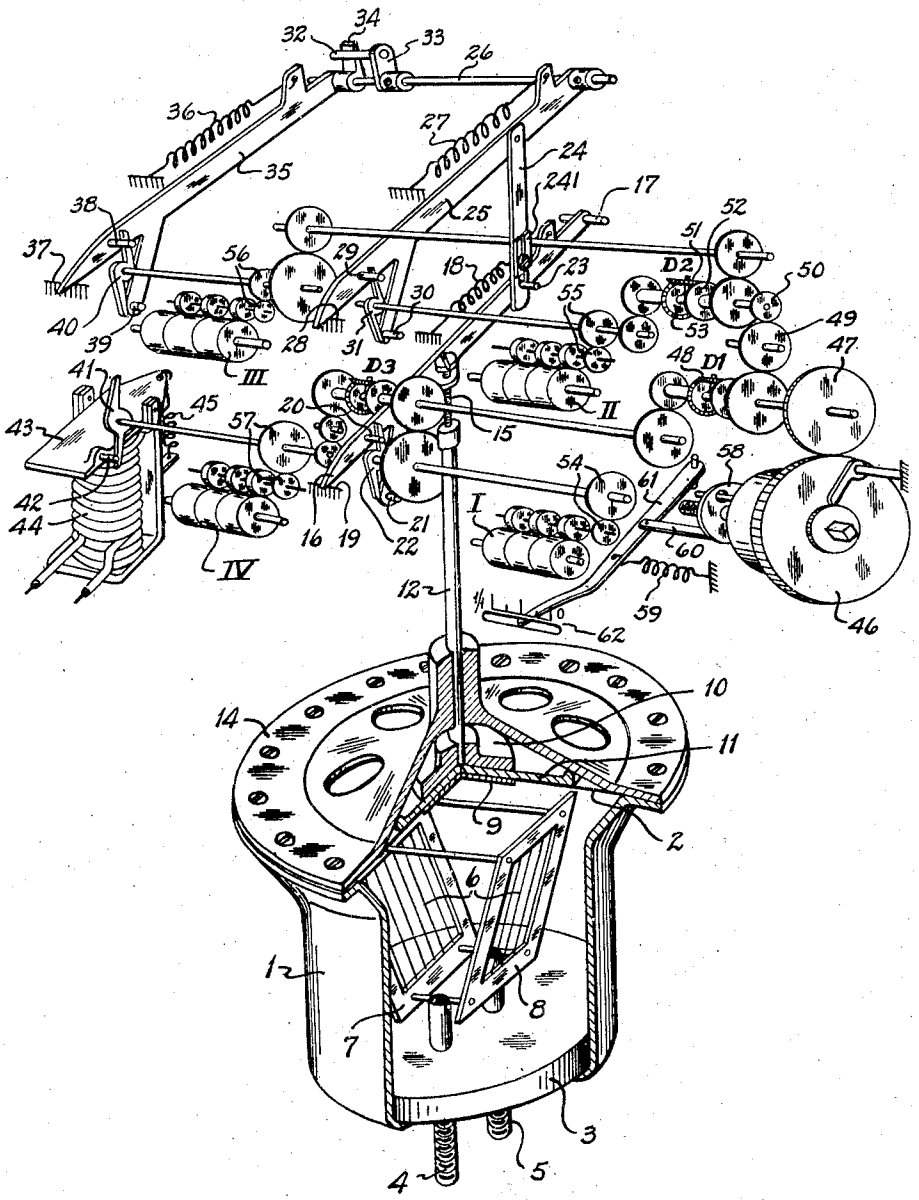

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RESPONSE COUNTER FOR TOTALIZING CURRENT SURGES OF VARYING MAGNITUDES

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The present invention relates to a response counter for overvoltages on long overhead lines due to atmospheric influences or switchings and has for its purpose numerically ascertaining the operation of overvoltage suppressors by taking into account the approximate strength of the arrester current.

The counting of occurring overvoltages makes the most exacting demands on a counting device, because currents present in the discharge gaps (spark-over of the arrester) are of extremely short surge duration varying in duration from 10^{-6} to 10^{-2} second of time.

Various devices have been brought forward so far for performing such counting, and which are based on magnetic, electro-dynamic, thermal or chemical action of the arrester current. There has been known a device, in which a fraction of the suppressed current flowing through the arrester traverses a heating filament housed in a gas-filled tank, whereby under the influence of the warmth produced a tank-sealing diaphragm acts upon a counter. This known arrangement has the disadvantage that it conveys no data as to the strength of the suppressed surges. In contra-distinction thereto the present invention represents a further evolution of such a device, being distinguished by the fact that for counting and measuring electric current surges of short duration (one millionth to a hundredth of a second) various spring-loaded counters are provided, being released in sequence through associated levers acted upon as a function of the lift of a diaphragm piston. Preferably, however, there is still provided another counter for counting a line current following after a surge.

The nature of the invention will be understood from the following specification taken with the accompanying drawing in which one embodiment is illustrated by way of example. Therein, numeral 1 designates a tank closed on top by a diaphragm and at the bottom by an insulating disc 3. Across the insulating disc 3 two current supply wires 4 and 5 lead to a heating filament 6 tightened on two small frames 7 and 8 of insulating material.

The diaphragm 2 is connected through two press-plates 9 and 10 with a pressure transferring disc 11. The upper press-plate 10 is at the same time adapted to support a diaphragm piston 12. A lid 14 serves for mounting and protecting the diaphragm 2 and is integral with a vertical bush for guiding the diaphragm piston 12.

The movement of the diaphragm piston 12 is

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transmitted over a set screw 15 on to a first trip-lever 16 being pivotally arranged about an axis 17 and biased by an adjustable spring 18 against an abutment 19. The free extremity of the trip-lever 16 is forked and each furcation carries a control pin 20 and 21 respectively for a release vane or wing 22.

A coupling pin 23 attached to the trip-lever 16 and sliding in a slot of a butt strap 24 (said slot being adjustable in its length by a plate 24^1) enables the movement of the trip-lever 16 to be transferred on to a second trip-lever 25 fulcrumed on an axis 26 and biassed by an adjustable spring 27 against a stop 28. The free extremity of the trip-lever 25 is forked and each furcation carries a control pin 29 and 30 respectively for a release wing 31.

The rotational movement of axis 26 is transferred on to a lever 33 being adjustably mounted thereon and fitted with a pin 32. Upon performance of a pre-given rotary angle, the pin 32 comes into operative connection with an offset portion 34 of a third trip-lever 35 being loosely mounted on axis 26 and biassed by an adjustable spring 36 against a stop 37. The free end of trip-lever 35 is again forked and each furcation carries a control pin 38 and 39 respectively for a release wing 40.

In addition to the already mentioned release wings 22, 31 and 40 there is provided another release wing 41 controlled by a pin 42 mounted on an armature 43 of a trip-relay 44. Thereby, in the position of rest, the armature is kept clear of the relay pole-piece by a spring 45 so that the control pin 42 lies in the path of the release wing 41.

All the release wings are subjected to the action of a spring motor 46. The transmission of the spring power to the release wings takes place through differentials D_1, D_2 and D_3 so as to enable each release wing to turn independently of one another. For instance, when the release wing 31 has been set free by the control pin 29, the spring power can be transferred from spring motor 46 and a pinion 47 on to an epicyclic wheel 48 of the differential gear D_1 and thence through the intermediate gears 49 and 50 on to an epicyclic wheel 51 of the differential D_2. Differential D_2 will accordingly actuate the counter wheels or registering mechanism II associated with trip lever 25 since release wing 31 under such condition is free to rotate. It is apparent that differential D_2 will not at such time transmit motion to registering mechanism III associated with trip lever 35 since the motion transmitting means in-

cluding gear 52 of differential D_2 is held against rotation by the locked release wing 40.

The rotational movements of the release wing axes are respectively transferred over the pairs of mating gears 54, 55, 56 and 57 on to the corresponding counting mechanisms I, II, III and IV as indicated.

The amount of the spring tension in motor 46 is indicated on a graduated scale 62 through the medium of a moving nut 58 and a spring-actuated lever system 60, 61.

The action of this arrangement is as follows:

A heating filament 6 housed within tank 1 is warmed proportional to the current surge according to the strength and duration of the impulse. This heating causes expansion of the air in tank 1. The pressure thus exerted acts on diaphragm 2 which flexes upwardly moving with it the piston 12. The movement of piston 12 is transferred through the set screw 15 on to the trip-lever 16 which, by counteracting a spring 18, is turned upwardly and upon completion of a certain definite path takes the control pin 20 out of the way of the release wing 22. Thus the release wing 22, being through two differential gears D_1 and D_2 subject to the action of the spring motor 46, suddenly begins to turn, but can only rotate through half a revolution, since the arrangement is so devised that the control pin 21 lies already within the path of the release wing 22 when the pin 20 releases it. The rotary movement of the wing 22 is transferred through a pair of gears 54 to the counting mechanism I which thus registers each operation.

If the lift of the diaphragm piston 12 grows to such an extent that the coupling pin 23 upon completion of the lost motion abuts on the adjustable stop 24^1, then the movement is transferred through the member 24 attached to the trip-lever 25, whereby the control pin 29 releases the wing 31 for half a turn. The rotational movement of the wing 31 is transmitted through the mating gears 55 on to the counter II which thus registers each operation.

With sufficiently great lift, the rotary movement of the trip-lever 25 is transferred across the axis 26 rigidly connected thereto, over crank 33 and pin 32 on to trip-lever 35, since with nullified play between 32 and 34, the pin 32 engages the offset portion 34 of trip-lever 35 and takes same against the action of the adjustable spring 36. In so doing the control pin 38 releases moreover the wing 40 whose rotary movement is conveyed through the mating gears 56 on to counter III causing same to switch forward through one figure.

The trip-relay 44 is in its turn only actuated if upon decay of an overvoltage surge there still flows a line current following it. In this case this relay gets energized so far that it attracts its armature 43, whereby the control pin 42 releases the wing 41. In this event, too, the conditions are so provided that the release wing 41 can each time only rotate through half a circle which turn is transferred through the mating gears 57 on to counter IV causing same to register another operation.

A front plate, as one may imagine for the example of embodiment described hereinbefore, has consequently four openings for the counters I, II, III and IV and an aperture for the spring index lever 61. On the counter I, II and III pressure surges of growing strength are indicated, whereby the counter I integrates surges of minor and the counter III those of major strength, whereas

counter II fulfills the same task for current surges of average strength. Due to the adjustability of the play between the diaphragm piston and the first trip-lever and between the various trip-levers one is free to select at will the strength of the surges to be counted. Hence the counters I, II and III indicate not only the number of the surges occurred, but valuable deductions may be made therefrom as to the energy of the current waves which has been effective.

Independently of the counters I to III, the counter IV registers the number of the cases in which a line current has followed a surge. Thus a small current surge causes actuation of register I, a larger surge causes actuation of registers I and II while a maximum current surge causes registers I, II and III to be actuated, and in case the surge is followed by a line current, register IV is additionally actuated.

The whole arrangement is so provided that the diaphragm need actuate only the extremely light designed trip-levers, whereas the driving of the counters requiring comparatively much power is assumed by a spring motor. By this it is attained that for tripping the counters a very slight power just suffices.

Since each counter involves but a very slight run down of the spring-barrel 46, a re-winding of the spiral spring readily suffices to perform several hundreds switchings, so that the afore-described response counter requires little attention.

Obviously, the counters remain not limited in number. There might be utilized just as well less or more than three units.

Both the heating filament 6 and the coil of the trip-relay 44 are placed in parallel on a voltage-dependent resistance (not shown) being put in series with the over-voltage arrester. This arrangement sets out to achieve that the current in the filament resistance 6 does not increase in proportion to the arrester current, but reaches only a peak value which lies far below that of the suppressor current. The voltage-dependent resistance has consequently a flattening effect and is intended to avoid a destruction of the filament resistance in the event of very intense discharges.

Obviously changes may be made by those skilled in the art in the apparatus herein described and illustrated within the purview of my invention.

I claim:

1. In a device for counting and measuring electric current impulses by utilizing a fraction of the suppressed current traversing an arrester resistance to move an element in accordance with the strength of the suppressed current, the combination of a plurality of spring loaded counters, individual escapements for each of said counters, selectively operable releasing means for the escapements, an actuator for said releasing means, said actuator being connected to each of said releasing means and simultaneously moving said releasing means to different extents in accordance with the strength of the suppressed current, one of said releasing means operating its escapement on movement of said actuator, and another releasing means operating solely on larger movements of said actuator.

2. A device as claimed in claim 1 in which all of said counters are connected to and loaded by a single spring motor.

3. A device as claimed in claim 2 in which the spring motor is drivingly connected to the counters through a plurality of differential gearings.

4. A device as claimed in claim 1 in which the escapement releasing means comprise a plural-

ity of interlinked levers movable to different degrees dependent on the strength of the current, one or more of said escapements being released by movement of said levers.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
351,164	Child	Oct. 19, 1886
1,403,182	Maturin	Jan. 10, 1922
1,513,811	Heinhold	Nov. 4, 1924
1,549,456	Creighton	Aug. 11, 1925
1,744,259	Carlson	Jan. 21, 1930
2,200,233	Whitehead	May 7, 1940
2,340,635	Anderson	Feb. 1, 1944
2,367,329	Berger	June 16, 1945